Future Perspectives: CPR Guidelines

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USA
Disclosures

- Financial: Compensated by the AHA for Senior Science Editor responsibilities, including:
  - Co-editor: *2010 AHA Guidelines for CPR and ECC*
  - Co-editor: *2010 International Consensus on CPR and ECC Science with Treatment Recommendations*

- Potential intellectual bias
Purposes of Presentation

- Review the challenges in maintaining a strong chain of survival and strengthening weak links
- Discuss implementation of new developments in BLS, ACLS and PALS Guidelines to improve survival
- Emphasize the need for more data
Achieving International Consensus on Resuscitation Science
Visit ILCOR Website to Review Evidence Evaluations
http://www.ilcor.org.home/
EVIDENCE-BASED RESUSCITATION GUIDELINES: Translating Science into Survival through Guidelines Development
Guidelines Development: Factors Affecting CPR Success

- **Patient factors**: What is most likely etiology and the CPR sequence most likely to improve survival?
- **Rescuer factors**: What can rescuer learn, remember and perform?
- **System factors**: What variables may be influencing survival?
Enhancing Chain of Survival

Prehospital Arrest
Activating EMS, Dispatcher
Bystander CPR
Early Defibrillation
Sudden Cardiac Arrest
Terminal Rhythm
“Adult” Cardiac Arrest
Time to Defibrillation and Survival of Witnessed VF Cardiac Arrest

When no bystander CPR is provided

Cummins, 1989
Cardiac Arrest 1-month Survival Related to Minutes to Defibrillation and Bystander CPR Compared to Late (EMS) CPR

Gothenburg data: Holmberg S et al, Resuscitation 2000; 47: 59
Case Presentation
Courtesy of Michael Sayre, MD

- 45 year old customer collapsed in a book store at ~ 12:24 PM.
- Many witnesses.
- Immediate 911 call
- Security guard responded with AED
- No CPR before AED arrival
Black line = ECG
Green line = Impedance
The shock worked. VF is gone & replaced by *pulseless* electrical activity. No compressions are taking place.
Outcome

- The victim died
- Recognition of emergency and use of AED insufficient
- Rescuers must be trained in and able to perform effective CPR until defibrillator is available AND after shock delivery
Targeting Key Outcomes

- Return of Spontaneous Circulation (ROSC)
- Survival to Hospital Admission
- Survival to Hospital Discharge with Good Neurologic Function
Targeting Key Outcomes

- Return of Spontaneous Circulation (ROSC)
- Survival to Hospital Admission
- Survival to Hospital Discharge with Good Neurologic Function

Most lives lost through delay in EMS call, CPR and defibrillation
Out of Hospital Adult Cardiac Arrest Chain of Survival (AHA)

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Increased Bystander CPR in CPR-Aware Communities

Resuscitation 102 (2016) 17–24

Clinical paper


Young Sun Ro^a, Sang Do Shin^b,*, Kyoung Jun Song^b, Sung Ok Hong^c, Young Taek Kim^c, Dong-Woo Lee^d, Sung-Il Cho^e

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^b Department of Emergency Medicine, Seoul National University College of Medicine, Seoul, Republic of Korea
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^d Ministry of Health and Welfare, Sejong, Republic of Korea
^e Department of Epidemiology, Graduate School of Public Health, Seoul National University, Seoul, Republic of Korea
Critical Functions of EMS Dispatchers

- Dispatchers must be trained to identify agonal gasps and other presentations of cardiac arrest.
- Dispatchers must provide immediate dispatcher-guided CPR.
- Auditing of EMS calls crucial to improve efficiency and effectiveness of dispatchers.
MEASURE

IMPROVE

Slide courtesy Tom Rea, MD, Seattle
VF Cardiac Arrest Survival Seattle & King County, 2002-2013

72% of witnessed arrests receive bystander CPR
EMS personnel achieve median ≥ 80%
CCFraction

Year
26% 28% 35% 45% 45% 49% 46% 49% 52% 57% 62%

Slide created and used with permission of Dr. Thomas Rea, Seattle, Washington.
Improvement in Bystander CPR

Bystander CPR increased – 6% to 12%

Year
2009 2010 2011

Bystander CPR increased – 6% to 12%

Implementation

Song *Resuscitation* 2011

Slide courtesy of Tom Rea, MD, Seattle
Increased Survival to Hospital Discharge

Survival increased from 7% to 9.4%

Song *Resuscitation* 2011

Slide courtesy of Tom Rea, MD, Seattle
Social Media Can Summon Rescuers and Increase Bystander CPR

- Social media technologies can summon rescuers in close proximity to a victim.
- Low evidence, but low risk with potential benefit

Screen shot: San Ramon Fire Department website: http://mobile.firedepartment.org/?rev=0?reload
Technology to Improve CPR Performance

Contents lists available at ScienceDirect

Resuscitation

journal homepage: www.elsevier.com/locate/resuscitation

Simulation and education

Smartwatches as chest compression feedback devices: A feasibility study

Yeongtak Song, Youngjoon Chee, Jaehoon Oh, Chiwon Ahn, Tae Ho Lim

a Convergence Technology Center for Disaster Preparedness, Hanyang University, Seoul, Republic of Korea
b School of Electrical Engineering, University of Ulsan, Ulsan, Republic of Korea
c Department of Emergency Medicine, College of Medicine, Hanyang University, Seoul, Republic of Korea
Guidelines Development: Factors Affecting CPR Success

- **Patient factors**: What is most likely etiology and the CPR sequence most likely to improve survival?
- **Rescuer factors**: What can rescuer learn, remember and perform?
- **System factors**: What variables may be influencing survival?
“Hands-Only” Bystander CPR

AHA Science Advisory

Hands-Only (Compression-Only) Cardiopulmonary Resuscitation: A Call to Action for Bystander Response to Adults Who Experience Out-of-Hospital Sudden Cardiac Arrest

A Science Advisory for the Public From the American Heart Association Emergency Cardiovascular Care Committee

Michael R. Sayre, MD; Robert A. Berg, MD, FAHA; Diana M. Cave, RN, MSN; Richard L. Page, MD, FAHA; Jerald Potts, PhD, FAHA; Roger D. White, MD

Bystanders who witness the sudden collapse of an adult should activate the emergency medical services (EMS) system and provide high-quality chest compressions by pushing hard and fast in the middle of the victim’s chest, with minimal interruptions. This recommendation is based on evaluation of recent scientific studies and consensus of the provision of chest compressions alone during bystander resuscitation (LOE 4*). Although these studies were not deemed sufficient to justify the elimination of ventilations from the bystander CPR sequence, the 1997 statement strongly encouraged further research that would focus on “...the timing, rate, and depth [of ventilations] as well as

Sayre et al., Circulation, 2008
Physiology of *Sudden* Cardiac Arrest

Oxygen content relatively high for first minutes

Slide courtesy of Tom Rea, MD, Seattle
Is Ventilation no longer part of CPR?

Slide courtesy of Jerry Nolan, MD
Witnessed, out-of-hospital ADULT PRIMARY CARDIAC arrest

Arrest 0-15 minutes:
compression-only = conventional CPR survival

Arrest beyond 15 minutes:
Conventional CPR = Twice the survival of compression-only and no CPR (survival very low with this group)
Weighing CPR Factors: Etiology

- Respiratory Failure
- Shock
- Drowning
- Injury
- Drug Overdose
- Arrhythmia
- Acute Coronary Syndromes

Conventional CPR vs. Chest Compression Only CPR
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Slide courtesy Tom Rea, MD, Seattle
Conventional CPR better than Compression Only for Children

Conventional and chest-compression-only cardiopulmonary resuscitation by bystanders for children who have out-of-hospital cardiac arrests: a prospective, nationwide, population-based cohort study

Tetsuhisa Kitamura, Taku Iwami, Takashi Kawamura, Ken Nagao, Hideharu Tanaka, Vinay M Nadkarni, Robert A Berg, Atsushi Hiraide, for the implementation working group for All-Japan Utstein Registry of the Fire and Disaster Management Agency

Summary

Background The American Heart Association recommends cardiopulmonary resuscitation (CPR) by bystanders with chest compression only for adults who have cardiac arrests, but not for children. We assessed the effect of CPR (conventional with rescue breathing or chest compression only) by bystanders on outcomes after out-of-hospital cardiac arrest.

Lancet, 2010
Weighing Etiology (5170 Children, 0-17 years of age)

Kitamura, Lancet, 2010

- 71% Non-cardiac
- 29% cardiac

Conventional CPR

Chest compression only CPR
Pediatric Cardiac Arrest
Conclusions (Kitamura, 2010)

- Some CPR more than doubled survival (OR: 2.59)
- Non-cardiac causes (71% of victims): Survival in children 1-17 years of age more than 5 times better with conventional CPR than with compressions only (few survivors with compressions only)
- Cardiac causes: conventional CPR equivalent to compression only
Impact of Dispatcher-Assisted Bystander Cardiopulmonary Resuscitation on Neurological Outcomes in Children With Out-of-Hospital Cardiac Arrests: A Prospective, Nationwide, Population-Based Cohort Study

Yoshikazu Goto, MD, PhD; Tetsuo Maeda, MD; Yumiko Goto, MD, PhD

Enrolled **5009 pediatric patients <18 years.** Conventional CPR was associated with increased odds of 1-month favorable neurologic outcomes irrespective of etiology of cardiac arrest (aOR, 2.30; 95% CI: 1.56 to 3.41). However, chest compression-only CPR was not associated with 1-month meaningful outcomes (aOR, 1.05; 95% CI: 0.67 to 1.64)
Figure 1. Crude Rates of 1-month Outcomes after Out-of-Hospital Cardiac Arrest in Japanese Children (GOTO, JAHA, 2014: 5009 patients, enrolled 2008-2010)

All, $P < 0.0001$

Slide Courtesy Bob Berg, from Y GOTO from Kanazawa University Hospital
### Table 7. Results of the Multivariable Logistic Regression Analyses for Variables Associated With 1-Month Outcomes

<table>
<thead>
<tr>
<th>Variables</th>
<th>Adjusted OR (95% CI)</th>
<th>1-Month Survival</th>
<th>1-Month CPC 1 to 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bystander CPR (vs. no bystander CPR)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chest compression only</td>
<td>1.10 (0.86 to 1.42)</td>
<td>1.05 (0.67 to 1.64)</td>
<td></td>
</tr>
<tr>
<td>Rescue breathing only</td>
<td>2.52 (1.45 to 4.21)</td>
<td>3.04 (1.18 to 6.78)</td>
<td></td>
</tr>
<tr>
<td>Conventional</td>
<td>2.14 (1.71 to 2.69)</td>
<td>2.30 (1.56 to 3.41)</td>
<td></td>
</tr>
</tbody>
</table>
Pediatric Dispatcher-Guided CPR Effects on Outcomes

Both bystander CPR and Bystander CPR with Dispatch Assistance improved survival. Adjusted odds ratios for survival to hospital discharge were 2.86 for Bystander CPR and 1.77 for Bystander CPR with Dispatch Assistance, compared with no CPR. Greatest effect occurred in children $\geq 1$ year.
Hands-Only © (Compression Only) CPR for Adults, SCA

Slide courtesy of Jerry Nolan, MD
Conventional CPR Remains Essential for Young Children—Watch for More Data

Modified from slide courtesy of Jerry Nolan, UK
Guidelines Development: Factors Affecting CPR Success

- **Patient factors:** What is the most likely etiology and the CPR sequence most likely to improve survival?

- **Rescuer factors:** What can rescuer learn, remember and perform well?

- **System factors:** What variables may be influencing survival?
Enhancing BLS Healthcare Provider Skills
Education and Continuous Quality Improvement
CPR Quality: Improving Cardiac Resuscitation Outcomes Both Inside And Outside The Hospital

A Consensus Statement from the American Heart Association

Peter A. Meaney, MD, MPH, Chair; Bentley J. Bobrow, MD, FAHA, Co-Chair; Mary E. Mancini, RN, PhD, NE-BC, FAHA; Jim Christenson, MD; Allan R. de Caen, MD; Farhan Bhanji, MD, MSc, FAHA; Benjamin S. Abella, MD, MPhil, FAHA; Monica E. Kleinman, MD; Dana P. Edelson, MD, MS, FAHA; Robert A. Berg, MD, FAHA; Tom P. Aufderheide, MD, FAHA; Venu Menon, MD, FAHA; Marion Leary, MSN, RN; on behalf of the CPR Quality Summit Investigators

Circulation 2013, TBD
## Metrics of High Performance CPR

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>1</td>
<td>Rate</td>
</tr>
<tr>
<td>2</td>
<td>Depth</td>
</tr>
<tr>
<td>3</td>
<td>CPR fraction</td>
</tr>
<tr>
<td>4</td>
<td>Full release</td>
</tr>
</tbody>
</table>

*Slide courtesy of Tom Rea, MD, Seattle*
MEASURE

IMPROVE

Slide courtesy Tom Rea, MD, Seattle
High Performance EMS CPR (Seattle)

Survival

Year

2001-03  2004

Implementation

Rea T. *Circulation* 2006;114:2760-5; Slide courtesy of Tom Rea, MD, Seattle.
AHA-COMPLIANT PEDIATRIC CHEST COMPRESSION DEPTH ASSOCIATED WITH SURVIVAL

Sutton, *Resuscitation* 2014
Teams Must Practice “Codes”—“Just in Time”

Slide courtesy Vinay Nadkarni, MD
Debriefing is Critical

Slide © Elizabeth Hunt, Johns Hopkins. Do not reproduce without permission

10/6/2016
Instructor-led Debriefing Improves Later CPR Performance

Research Article

Comparison of instructor-led versus peer-led debriefing in nursing students

Young Sook Roh PhD, RN,1 Michelle Kelly PhD, MN, BSc, RN2 and Eun Ho Ha PhD, RN3
1Red Cross College of Nursing, Chung-Ang University, Seoul, Republic of Korea, 2School of Nursing, Midwifery & Paramedicine, Curtin University, Australia and 3Department of Nursing, Jungwon University, Chungbuk, Republic of Korea
Debriefing Summary Information Can be Misleading

Resuscitation Duration (min): 20
Resuscitation Average Depth (in): 2.2
Resuscitation Average Rate (cpm): 122
Resuscitation Chest Compression Fraction (%): 95.70%
Each vertical line is a Compression; each dot in row above is a compression used to calculate RATE.

Measured Data Duration (first to last compression time) 00:20:41.0
**BIOPSY: 1-MINUTE EPOCHS PROVIDE MULTIDIMENSIONAL VIEW OF COMPLIANCE**

- **Goal Depth:** > 2.0 in
- **Goal Rate:** 100-120 cpm
- **Goal Chest Compression Fraction (CCF):** > 90%

**Compliant EPOCH = Depth & Rate & CCF**

---

<table>
<thead>
<tr>
<th>Epoch</th>
<th>CCF</th>
<th>Avg. Depth</th>
<th>Avg. Rate</th>
<th># Pauses &gt; 1s</th>
<th>Time &gt; 10s</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>91.1%</td>
<td>1.9 in</td>
<td>132 cpm</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>100.0%</td>
<td>2.0 in</td>
<td>125 cpm</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>96.0%</td>
<td>2.0 in</td>
<td>123 cpm</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>84.3%</td>
<td>2.0 in</td>
<td>105 cpm</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>100.0%</td>
<td>1.9 in</td>
<td>104 cpm</td>
<td>0</td>
<td>0</td>
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<tr>
<td>6</td>
<td>52.8%</td>
<td>2.6 in</td>
<td>115 cpm</td>
<td>0</td>
<td>0</td>
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<tr>
<td>7</td>
<td>100.0%</td>
<td>2.0 in</td>
<td>122 cpm</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>84.3%</td>
<td>2.5 in</td>
<td>117 cpm</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>9</td>
<td>100.0%</td>
<td>2.3 in</td>
<td>111 cpm</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>87.4%</td>
<td>2.2 in</td>
<td>120 cpm</td>
<td>0</td>
<td>0</td>
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<tr>
<td>11</td>
<td>100.0%</td>
<td>2.2 in</td>
<td>124 cpm</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>12</td>
<td>100.0%</td>
<td>2.3 in</td>
<td>122 cpm</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>13</td>
<td>100.0%</td>
<td>2.2 in</td>
<td>125 cpm</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>14</td>
<td>100.0%</td>
<td>2.3 in</td>
<td>129 cpm</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>15</td>
<td>100.0%</td>
<td>2.5 in</td>
<td>129 cpm</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>16</td>
<td>100.0%</td>
<td>2.4 in</td>
<td>127 cpm</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>17</td>
<td>100.0%</td>
<td>2.6 in</td>
<td>112 cpm</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>18</td>
<td>100.0%</td>
<td>2.6 in</td>
<td>129 cpm</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>19</td>
<td>100.0%</td>
<td>2.5 in</td>
<td>130 cpm</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>20</td>
<td>75.1%</td>
<td>1.8 in</td>
<td>127 cpm</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>21</td>
<td>100.0%</td>
<td>1.8 in</td>
<td>120 cpm</td>
<td>0</td>
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</tbody>
</table>

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*Slide © Elizabeth Hunt, Johns Hopkins. Do not reproduce without permission*
Enhancing ACLS and PALS Skills
Post-Cardiac Arrest Care
Physiologic Monitoring During CPR—End-Tidal CO₂
End tidal CO$_2$ will rise as pulmonary blood flow and overall cardiac output rises, assuming no change in ventilation (tidal volume and rate).

Quantifying effectiveness of compressions

$Jin$, *CCM*, 2000
Monitoring of $P_{ET}CO_2$ During Resuscitation (© Am Heart Assn)

- Deeper compressions
- Faster compressions
  - Fewer interruptions in compressions
- Reduce leaning between compressions
  - Stop excessive ventilation
Post-Resuscitation Care

- Treat reversible causes (include possible adult PCI)
- Provide Targeted Temperature Management
- Use protocols to support
  - respiratory function
  - cardiovascular function
  - electrolyte balance, normoglycemia
- Post ROSC—titrate inspired O$_2$ to SpO$_2$ 94-99%
- Gather data
No Fever improves Survival

Table 11
Multivariate logistic-regression analysis revealing independent factors associated with survival to discharge (dependent variable) among patients admitted to hospital (N = 166)

<table>
<thead>
<tr>
<th></th>
<th>OR (95% CI)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (≤ 71/&gt; 71 years)</td>
<td>4.98 (1.87–13.29)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Overall performance category (1–3)</td>
<td>2.58 (1.24–5.35)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>pre-arrest</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interval: call receipt-start CPR (≤ 1/&gt; 1 min)²</td>
<td>2.47 (1.10–5.58)</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>Adrenaline (no/yes)</td>
<td>15.93 (5.20–48.83)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Seizures (no/yes)</td>
<td>2.72 (1.09–8.82)</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>BE &gt; −3.5/ ≤ −3.5 mmol l⁻¹</td>
<td>1.12 (1.02–1.23)</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>Temperature ≤ 37.8/&gt; 37.8 °C</td>
<td>2.67 (1.17–6.20)</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>S-glucose ≤ 10.6/&gt; 10.6 mmol l⁻¹</td>
<td>2.58 (1.11–5.85)</td>
<td>&lt; 0.05</td>
</tr>
</tbody>
</table>
Adult Targeted temperature management (TTM) following ROSC from Cardiac Arrest

- Recommended for all comatose patients
- Select, maintain (for ≥24 hours) constant temperature between 32°C and 36°C
- Actively prevent fever beyond 24 hrs if patient comatose.
- Routine *prehospital cooling* of patients with rapid infusion of cold IV fluids not recommended

© American Heart Association
Targeted Temperature Management in Children

**Recommended**

- For children who are comatose following ROSC, 5 days of normothermia (36°C - 37.5°C)  
  or
- 2 days of hypothermia followed by 3 days of normothermia
  
  **AND**

- Prevent or aggressively treat fever post-cardiac arrest

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Quality of Hospital Care Matters

Slide courtesy of Tom Rea, MD, Seattle
Moving Hospitals Toward A Performance Improvement Approach For In-Hospital Cardiac Arrest

Five Key Metrics Based On Data Of What Matters

1. Increase Survival to Discharge
2. Decrease Unmonitored/Unwitnessed Arrests
3. Decrease Time to Chest Compressions
4. Decrease Time to Defibrillation
5. Confirmation of Endotracheal Tube Placement
Survived to Discharge 2014
5168 (25.2%) Adult
241 (48.8%) Pediatric (0-18yrs)
187 (45.9%) Newborn/Neonates
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Slide courtesy Tom Rea, MD, Seattle
Improving Outcomes of Adult OHCA: Seongbuk, Seoul, Korea

2015 European Journal of Emergency Medicine

A system-wide approach from the community to the hospital for improving neurologic outcomes in out-of-hospital cardiac arrest patients

Won Sook Hwang\textsuperscript{a,b}, Jong Su Park\textsuperscript{c}, Su Jin Kim\textsuperscript{c}, Yun Sik Hong\textsuperscript{c}, Sung Woo Moon\textsuperscript{c} and Sung Woo Lee\textsuperscript{c}

Objective In the present study, we aimed to determine the effects of a system-wide approach from the community to the hospital in improving the neurologic outcomes in out-of-hospital cardiac arrest (OHCA) patients within Seongbuk.
System-wide Improvements: Seongbuk, Seoul, Korea

2009-2013

- Early EMS Activation (< 1 min)
- Bystander CPR (± Dispatcher Guidance)
- Appropriate prehospital AED use
- High-quality ACLS (capnography, ECPR)
- High-quality post-cardiac arrest care (including therapeutic hypothermia, percutaneous coronary intervention)
Results of System-wide Improvements: Seongbuk, Seoul, Korea

- Early EMS
- Bys CPR
- ICU Adm
Improved Survival, Adult OHCA
Seongbuk, Seoul, Korea

- Witnessed VF Arrest
- All Arrests

2009-2010 (n=182) 2011 (n=117) 2012-2013 (n=282)
Summary of Presentation

- Reviewed the challenges in maintaining a strong chain of survival and strengthening weak links
- Discussed implementation of new developments in BLS, ACLS and PALS Guidelines to improve survival
- Emphasized the need for more data
Thank you very much!
Simulation-based mock codes significantly correlate with improved pediatric patient cardiopulmonary arrest survival rates*

Pamela Andreotta, PhD; Ernest Saxton, BSN; Maureen Thompson, MSN; Gail Annich, MD

Objectives: To evaluate the stability and effectiveness of a simulation-based pediatric mock code program on patient outcomes, as well as residents' confidence in performing resuscitations. A resident's leadership ability is integral to accurate and efficient clinical response in the successful management of cardiopulmonary arrest (CPA). Direct experience is a contributing factor to a resident's code..

Results: Survival rates increased to approximately 50% (p = .000), correlating with the increased number of mock codes (p = .07). These results are significantly above the average national pediatric CPA survival rates and held steady for 3 consecutive years, demonstrating the stability of the program's outcomes.

Conclusions: This study suggests that a simulation-based mock code program can significantly improve patient survival outcomes and residents' confidence in performing resuscitations.

Total of 228 residents involved. Patient survival increased from 33 to 56% over 1 year then remained at 56% for three years after monthly mock codes implemented.

5-Minute Booster Training Improves CPR Skills

Low-Dose, High-Frequency CPR Training Improves Skill Retention of In-Hospital Pediatric Providers

AUTHORS: Robert M. Sutton, MD, MSCE, Dana Niles, MS, Peter A. Meaney, MD, MPH, Richard Aplenc, MD, Benjamin French, PhD, Benjamin S. Abella, MD, Evelyn L. Lengetti, MSN, Robert A. Berg, MD, Mark A. Helfaer, MD, and Vinay Nadkarni, MD.

WHAT’S KNOWN ON THIS SUBJECT: Low-dose, high-frequency cardiopulmonary resuscitation (CPR) training has not been rigorously evaluated previously.

WHAT THIS STUDY ADDS: This study is the first to demonstrate that low-dose, high-frequency CPR training can improve CPR skill retention of pediatric providers.

Sutton et al, Pediatrics, 2011
Low Dose, High Frequency CPR Training Improves Skills


- 4 to 5-min booster training improves CPR skill retention
- AED-feedback alone results in lower CPR skill retention rate than instructor-guided training
- Effect on survival not yet established
Summary of 2015 Guidelines Update

- We must rededicate ourselves to improving the frequency of bystander CPR and the quality of CPR and post–cardiac arrest care provided.
Clinical paper

Therapeutic hypothermia and outcomes in paediatric out-of-hospital cardiac arrest: A nationwide observational study

Ikwan Chang\textsuperscript{a}, Young Ho Kwak\textsuperscript{a,\ast}, Sang Do Shin\textsuperscript{a}, Young Sun Ro\textsuperscript{b}, Eui Jung Lee\textsuperscript{a}, Ki Ok Ahn\textsuperscript{b}, Do Kyun Kim\textsuperscript{a}

\textsuperscript{a} Department of Emergency Medicine, Seoul National University Hospital, Seoul, Republic of Korea
\textsuperscript{b} Laboratory of Emergency Medical Services, Seoul National University Hospital Biomedical Research Institute, Republic of Korea